ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
BADGER ARMY AMMUNITION PLANT
BARABOO, WISCONSIN

EXECUTIVE SUMMARY

PREPARED FOR

THE DEPARTMENT OF THE ARMY

OMAHA DISTRICT
CORPS OF ENGINEERS
CONTRACT No. DACA45-81-C-0017

BY

energy masters corporation

11880 College Blvd.
Suite 520
Overland Park, Kansas 66210

FINAL REPORT

DECEMBER 30, 1983

BADGER AAP
BARABOO, WISCONSIN

REPORT TABLE OF CONTENTS *

* A volume Table of Contents is included at the front of each volume.

BADGER AAP
BARABOO, WISCONSIN

EXECUTIVE SUMMARY

TABLE OF CONTENTS

BADGER AAP
BARABOO, WISCONSIN

GRAPHS AND CHARTS

TABLE OF CONTENTS

BADGER AAP
BARABOO, WISCONSIN
EXECUTIVE SUMMARY

ES-1.0 AUTHORITY FOR STUDY

This study is being performed and the resulting report prepared by Energy Masters Corporation of Overland Park, Kansas, under Contract No. DACA45-81-C-0017, as issued by the Corps of Engineers, Omaha District. *Contract Date 7 April, 1981.

ES-2.0 PURPOSE OF THE STUDY

The purpose of this study and report is to develop a systematic program of energy consumption reductions in compliance with the stated goals of the Army Facilities Energy Plan (AFEP). This report will:

- Develop a systematic plan of energy conservation opportunities (ECO's) that will meet the objectives of the AFEP.
- Develop a coordinated facility-wide energy study.
- Prepare DD Form 1391 and Project Development Brochure (PDB's) and required documentation for feasible projects.
- Include all practical energy conservation methods and determine economic feasibility in accordance with given guidelines.
- List and prioritize recommended projects.
- NOTE: No previous studies have been performed at BAAP.

*A copy of the Scope is included in the Appendix

This report will summarize ECO's developed under Increments A, B, E, F, and G. Backup data PDB's and DD Form 1391 for Increments A, B, and G, are included in Appendices to this report. ECO's developed as part of Increments E and F are also summarized with backup data in the Appendices. DD Form 1391 and PBD's are not required for Increments E and F. Increments C and D are not included in the scope of this study.

ES-3.0 STUDY METHODOLOGY

Since the study was to be performed facility-wide, and BAAP has been inactive since 1975, some method to determine energy usage during future mobilization had to be developed.

Normally, a study would include a survey of energy-using equipment, i.e., hours of usage, motor horsepower, amperage, steam consumption, etc. Assimilating this data presented an immediate problem: A large amount of the process equipment had been removed, and most of the utilities turned off. The remaining process and mechanical equipment had been disassembled, mothballed, motors stored away, and equipment nameplates lost, removed, or painted over.

BADGER AAP
BARABOO, WISCONSIN
EXECUTIVE SUMMARY

The alternate energy usage projection used for plant mobilization was based upon recent historical data. A review of this data revealed that:

1. The FY 1969 was the highest use of energy in recent production history. See ESBG-1.

2. The FY 1969 was not a year of maximum production.

3. Coal was used in 1969. (Increment E required a study to convert to coal usage with oil as a backup.) The existing boilers in Boiler House I were converted from coal to oil-fired in 1972.*

Based upon the available data, certain assumptions could be made about energy usage during mobilization:

1. Coal would probably be the primary source of boiler fuel.**

2. Energy usage would increase over FY 1969 usage because of increased production.

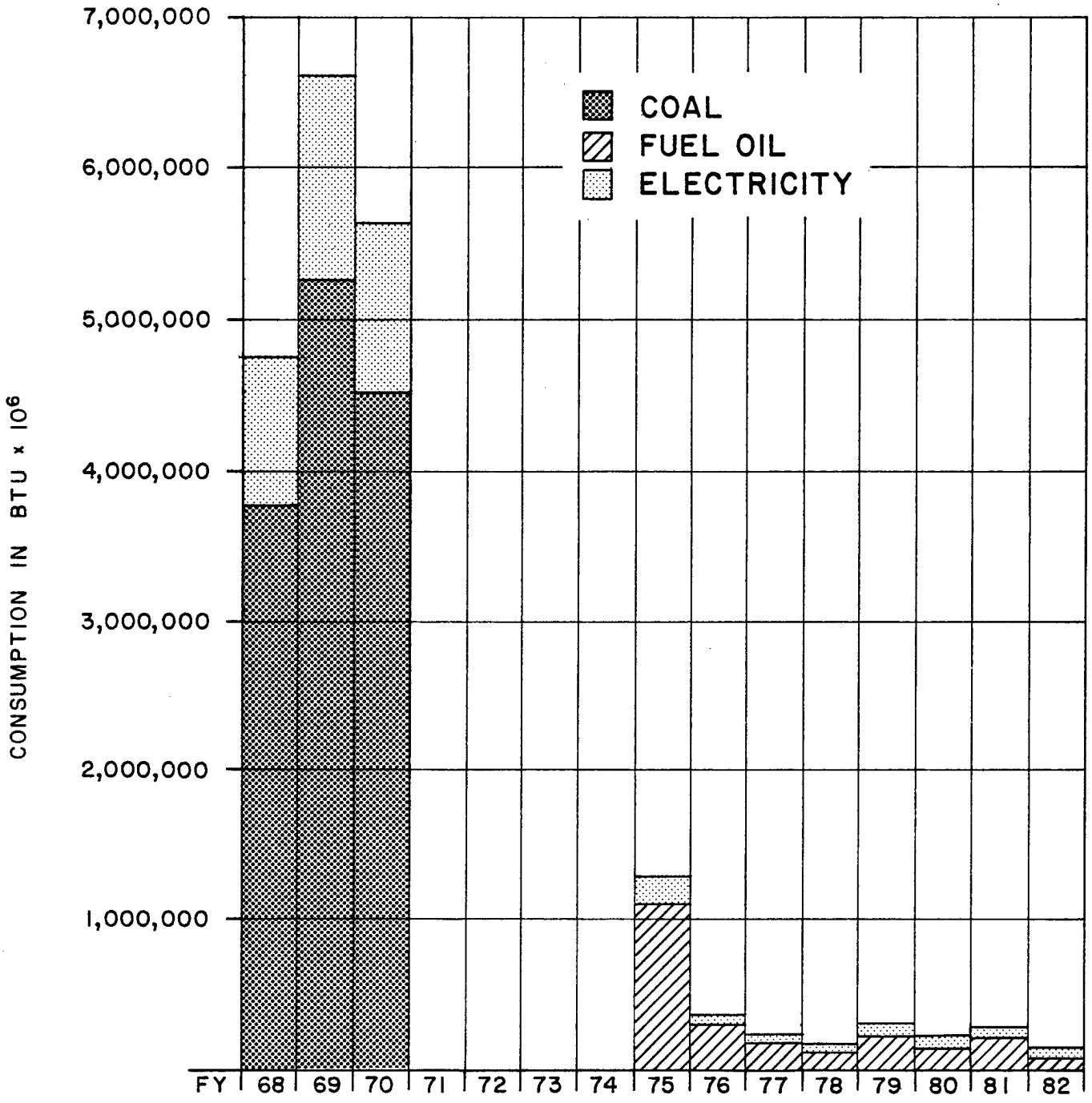
For these reasons, the consumption of coal and electricity in FY 1969 was increased by 25% to establish a baseline usage assuming mobilization. This usage is, admittedly, arbitrary and could vary, depending upon production levels, equipment efficiency, ECO's implemented, as well as any changes in BAAP's Mission.

*Boiler House II is still coal-fired, though the plant has never been in full time operation.

**The AFEP requires reduction of dependence on critical fuels, i.e., conversion of oil to coal.

BADGER AAP
BARABOO, WISCONSIN

EXECUTIVE SUMMARY



ACTUAL FUEL CONSUMPTION IN BTU x 10^6

BAR GRAPH ESBG-1

A Baseline Consumption of 7,993,600 Btu/Yr. was established by this method. This usage included 164,758,650 kwh of electricity and 371,562 tons of coal.

Graphs and tables showing monthly historical and estimated Baseline Consumption can be found in Appendix Volume III, Paragraph 4.2.3. The projected "Baseline Consumption at Mobilization" on a monthly basis can be found in the Table ES-1 on the following page. This data is based upon escalated historical billed utility and actual coal usage.

ES-4.0 ENERGY CONSERVATION MEASURES

Badger AAP has pursued, and is pursuing, an active Energy Management Program in its active buildings. This program has accomplished several energy reduction goals:

- The five main boilers in Powerhouse I have been shut down, and steam mains to inactive buildings closed off.
- Heat to active buildings is supplied by the smaller boilers in Powerhouse I, or by small package boilers in remote buildings.
- Offices and facilities were consolidated, and some functions rescheduled to off-peak hours.

BADGER AAP
BARABOO, WISCONSIN

EXECUTIVE SUMMARY
TABLE ES-1

BADGER AAP
BARABOO, WISCONSIN

UTILITY USAGE AND COST ---- BASELINE

	ELECTRICITY								COAL			BTU USAGE		
	KWD			KWH										
	OFF PEAK	ON PEAK	$	OFF PEAK	ON PEAK	$	HIGH VOLTAGE CREDIT $	TOTAL $ COST	TONS OF COAL @ 10,000 BTU/#	$* COAL	ELEC. $BTU \times 10^6$	COAL $BTU \times 10^6$	TOTAL USAGE $BTU \times 10^6$
J	23,730	23,730	166,110	7,429,104	5,379,696	344,096	(58,732)	451,474	35,670	1,640,820	148,582.1	713,400	261,982.1
F	23,000	23,000	161,000	7,270,300	5,264,700	336,740	(57,087)	440,653	33,440	1,538,240	145,406.0	668,800	814,306.0
M	23,200	23,200	162,400	8,275,440	5,992,560	383,296	(59,765)	485,931	37,156	1,709,176	165,508.8	743,120	908,628.8
A	25,110	25,110	175,770	8,519,823	6,169,527	394,615	(63,673)	506,712	33,440	1,538,240	170,396.5	668,800	939,196.5
M	24,050	24,050	168,350	7,950,930	5,757,570	368,265	(60,526)	476,089	29,725	1,367,350	159,018.6	594,500	753,518.6
J	25,000	25,000	175,000	8,845,000	6,405,000	409,676	(64,234)	520,442	27,495	1,264,770	176,900.0	549,900	726,800.0
J	24,150	24,150	169,050	8,334,165	6,035,085	386,016	(61,563)	493,503	24,523	1,128,058	166,683.3	490,460	657,143.3
A	24,470	24,470	171,290	8,160,745	5,909,505	377,983	(61,722)	487,551	23,780	1,093,880	163,214.9	475,600	638,814.9
S	25,000	25,000	175,000	8,555,000	6,195,000	396,244	(63,562)	507,682	26,381	1,213,526	172,993.3	527,620	700,613.3
O	24,150	24,150	169,050	8,264,130	5,984,370	382,772	(61,401)	490,421	31,583	1,452,818	165,282.6	631,660	796,942.6
N	23,300	23,300	163,100	6,621,860	4,795,140	306,706	(56,110)	413,696	33,069	1,521,174	132,437.2	661,380	793,817.2
D	23,200	23,200	162,400	7,333,520	5,310,480	339,668	(57,583)	444,485	35,300	1,623,800	146,670.4	706,000	852,670.4
TOTAL			$2,018,520	95,560,017	69,198,633	$4,426,077	($725,958)	$5,718,639	371,562	$17,091,852	1,913,093.7	7,431,240	9,344,433.7
				164,758,650									

*Includes estimated transportation charges to the plant.

6

- An ongoing employee awareness program was instituted.
- Added insulation to active buildings.

Planned and/or Funded Projects include:

- Reducing operating temperatures and installing night setback thermostats in active buildings. (ECAM FY 1986).
- Installing energy efficient lighting and turning off lighting. (ECAM FY 1986).
- Adding insulation to steam mains in the Administration Area. (ECAM FY 1983).
- Installing storm windows (ECAM FY 1986).
- Caulking and weatherstripping (ECAM FY 1986).

ES-5.0 ECO'S STUDIED

ES-5.1 INCREMENT A AND B

Because BAAP is an inactive facility with only a few active buildings, it was determined that projects recommended under Increments A and B should be divided into two categories: those projects recommended for inactive buildings and systems which would have future energy conservation benefits under mobilization; and those projects recommended for active buildings and

systems which would have immediate energy conservation benefits.

The list of projects studied is the same for active and inactive facilities, and is summarized in Table ES-2, showing the application to active or inactive buildings. A brief description of each project is shown below:

ES-5.1.1 Architectural

- Install or supplement existing roof insulation to reduce conduction.
- Install or supplement existing wall insulation to reduce conduction.
- Remove unnecessary windows and close, seal, and insulate openings.
- Install storm window on remaining windows. This will reduce both conduction and infiltration.
- Replace existing exterior doors that are rotted, in poor condition, and leaking air.
- Install vestibules at high traffic entrances to reduce infiltration.
- Caulk and weather strip existing loose-fitting doors and windows to reduce infiltration.

- Install window shading devices or reflective film to reduce solar gain.
- Enclose stairwells in Building 200, and install pedestrian doors to prevent overheating of Second Floor, due to movement of warm air up to the open stairwells.

ES-5.1.2 Mechanical

- Collect wasted condensate from heating and non-contaminated process within each building, and feed by gravity to underground local collection tanks. Insulate exposed piping.
- Install an aboveground pumped condensate return system from local collection tanks to the main powerhouse. Insulate piping.
- Install steam control valves with zone heating stats and night setback thermostat to control each zone.
- Insulate domestic hot water piping.
- Install economizer cycle with enthalpy control on existing AHU's for "free cooling" in moderate weather.
- Insulate steam piping in buildings.
- Add insulation to aboveground steam mains.
- Install an Energy Management Control System.

ES-5.1.3 Electrical

- Replace existing incandescent fixtures with fluorescent. Install switching and task lighting for maximum benefit of energy use reduction.
- Power factor adjustment.
- Install energy efficient lighting.

TABLE ES-2

PROJECTS STUDIED FOR BADGER AAP

PROJECT	BUILDINGS ACTIVE	BUILDINGS INACTIVE	PLANTWIDE	COMMENTS
INSTALL ROOF INSULATION	X	X		See Volumes I and II
INSTALL WALL INSULATION	X	X		See Volumes I and II
REMOVE EXCESSIVE WINDOWS	X	X		See Volumes I and II
INSTALL STORM WINDOWS	X	X		See Volumes I and II
REPLACE EXTERIOR DOORS	X	X		See Volumes I and II
INSTALL VESTIBULES	X	X		See Volumes I and II
CAULK & WEATHER STRIP	X	X		See Volumes I and II
INSTALL WINDOW SHADING	X	X		See Volumes I and II
ENCLOSE STAIRWELLS	X			Dropped, due to a lack of Bldg.A/C
COLLECT & RETURN CONDENSATE			X	See Volume I
STEAM VALVES & STATS	X	X		See Volumes I and II
INSULATE DOM. H. WATER	X	X		See Volumes I and II
INSTALL ECONOMIZERS	X	X		See Volumes I and II
INSULATE STEAM PIPING			X	See Volume I
EMCS	X	X	X	See Volumes I and II
ENERGY EFFICIENT LIGHTING	X	X	X	See Exec. Summary Appendix
POWER FACTOR ADJUSTMENT	X	X	X	See Volumes I and II
CONVERT BOILERS TO COAL			X	See Exec. Summary Appendix
NEW CONGENERATION PLANT			X	See Volume II
CONVERT BOILERS TO GAS	X			See Volume II
UPDATE EXISTING PLANTS			X	See Volume I See Volume V

ES-5.2 INCREMENT E

Increment E projects for the central boiler plants are detailed in Appendix Volume V. A brief description of the projects studied is listed below:

INACTIVE FACILITIES:

- Conversion of Powerhouse I to coal-fired, with oil backup, and modernization of coal handling and other plant facilities. Study Plan I.
- Place Powerhouse II in operation (already coal-fired) including modernization of coal handling and other plant facilities. Study Plan I.
- Installation of a new coal-fired central boiler-house with cogeneration capabilities. Study Plan II.

ACTIVE FACILITIES:

- Convert four existing 22,000 PDS/Hour boilers in Powerhouse I from oil-firing to gas-fired with oil as a standby fuel. Study Plan IV.

EXISTING OPERATION:

- Study Plan III is continuing to fire all boilers in their present manner and updating facilities as required. This plan was developed as a means of comparing cost of operation of existing facil-

ities to savings generated by the implementation of other study plans. It does not meet ECIP criteria and is only evaluated under Increment F for operation and maintenance funding by the Facilities Engineer.

ES-5.3 INCREMENT F

Operation and Maintenance projects that could be performed under Increment F for funding by the Facilities Engineer are listed below. An exact determination of the scope of most of the individual projects listed could not be established during the field study. Steam, electricity, and water systems have been turned off or disconnected in inactive buildings and/or plant areas. This made the actual testing of systems and components impossible.

- Test and repair or replace steam traps, leaking valves, valve stems, or packing. Steam traps, valves, etc., on inactive steam lines could not be checked for leaks or proper operation.
- Check piping, radiators, coils, refrigeration systems, compressed air systems, air handling systems, steam systems, water systems, and process equipment for plugs and leaks, and repair as necessary. Leaks and faults in energy distribution systems could not be established in non-functioning systems.

- Reduce domestic hot water temperatures, and install flow restrictors. Hot water temperatures would be set when systems are started up and flow rates established.
- Install time clocks and/or manual timers to shut off exhaust fans and other items of equipment when their operation is not required. A determination must be made at the time of mobilization where time clocks or timers could be used.
- Relamp using low-wattage multivapor lamps in high bay areas and in exterior fixtures on an as-required basis. Lamp replacement is a maintenance item.
- Install vestibules at high traffic entrances. Restrict normal usage to these entrances.
- Update existing Boiler Plant Facilities - See Study Plan III, Volume V.

ES-5.4 INCREMENT G

The following projects are recommended, but do not qualify for ECAM funding: (See Volume II, Tab F, Para. F1.0)

Inactive Facilities:

- Install low wattage lighting.
- Return steam condensate to Powerhouses 1 and 2.

ES-6.0 PROJECT PRIORITY LISTING

A complete list of all projects studied and proposed, both qualifying and non-qualifying, is shown in Table ES-3. These projects are listed in descending order of their E/C Ratio. Each of these projects is listed with a brief description under "ECOS Studied - Increments A and B, Increment E, Increment F, and Increment G". It should be understood that the energy savings for each project are not necessarily additive. Because the implementation of one project can affect the total savings of succeeding projects, the total actual savings will probably be less than the sum of all the individual projects.

ES-6.1 RECOMMENDED PROJECTS

The proposed projects listed in Table ES-3 were submitted to the Facilities Engineer at BAAP. Following his advice and recommendations, these projects were packaged into those projects which, individually or in a group, would be recommended for implementation. These projects are listed in Table ES-4 in descending order of priority. It was also determined that many of these projects could be implemented on a limited scale to increase energy conservation in active

buildings. The recommendations were, therefore, re-packaged for active buildings under Current Operating Status. These projects are listed in descending order of priority in Table ES-5.

BADGER AAP
BARABOO, WISCONSIN

TABLE ES-3

LIST OF ALL PROJECTS STUDIED

PROJECT TITLE	$ COST	SAVINGS IN BTU 10^6	B/C RATIO	E/C RATIO	SIMPLE PAYBACK YEARS	ACTIVE	INACTIVE
nsulate Exist. Steam Mains	12,250,700	2,079,204	4.5	169.7	2.2		X
eplace Doors & Windows - Caulk and Weather Strip	178,200	22,527	3.3	126.4	2.9	X	
nsulate Bldg. Walls & Ceilings	5,487,000	462,246	2.2	84.2	4.4		X
eplace Doors & Windows - Caulk & Weather Strip	8,713,100	579,605	1.7	66.5	5.5		X
team Valves & Night Stats	118,800	7,516	1.5	63.3	6.2	X	
Insulate Dom. H.W. Systems	320,100	15,786	1.3	49.3	7.5		X
Insulate Dom. H.W. Systems	12,320	527	1.8	42.8	3.2	X	
Insulate Bldg. Walls & Ceilings	507,100	19,054	1.0	37.6	9.8	X	
Close Excess Window Openings	149,600	4,110	1.4	27.5	4.4	X	
Close Excess Window Openings	225,500	4,338	0.7	19.5	13.3		X
Insulate Existing Steam Mains	411,400	7,516	0.5	18.3	20.1	X	
Energy Efficient Lighting	1,180,300	15,841	1.6	13.4	5.7		X
Return Steam Condensate	1,285,460	14,810	1.3	11.3	6.0	X	
Install Storm Windows & Vestibules	3,367,100	29,713	0.1	8.8	154.2		X
Return Steam Condensate	30,899,000	231,199	0.7	7.4	13.3		X
Energy Efficient Lighting	137,500	631	0.5	4.6	16.8	X	
Install Storm Windows and Vestibules	506,000	2,322	0.0	4.6	333.8	X	
Install Economizer on Cooling	72,600	100	0	1.4	330		X
Install Economizers on Cooling	1,100	1	-0.2	.9	-64.7	X	
Convert Boilers to Gas	200,091	-0-	3.3	-0-	2.3	X	
Cogeneration Boiler Plant	115,815,600	-751,120	0.6	-6.5	4.7		X
Enclose Stairs Bldg. 200	DELETED AT OWNER/USERS REQUEST						
Install EMCS	DELETED - NOT FEASIBLE					X	X
Install Stm. Vanes & Night Setback	NOT FEASIBLE FOR 24 HR/DAY OPERATION						X
Convert Boilers To Coal	42,297,541	7,270,000	-0.2	-0-	2.5		X

TABLE ES-4

PROJECTS FOR IMPLEMENTATION ON MOBILIZATION (INACTIVE BUILDINGS)

PROJECTS	$ COST	SAVINGS IN BTU 10^6	B/C RATIO	E/C RATIO	SIMPLE PAYBACK	RECOMMENDED	NOT RECOMMENDED	ACTION
Insulate Existing Steam Mains	12,250,700	2,079,204	4.5	169.7	2.2	X (1)		SEE VOLUME II, TAB C
Insulate Bldg. Walls and Ceilings	5,487,000	462,246	2.2	84.2	4.4	X (2)		SEE VOLUME II, TAB B
Replace Doors & Windows - Caulk and Weatherstrip	8,713,100	579,605	1.7	66.5	5.5	X (2)		SEE VOLUME II, TAB B
Insulate Domestic Hot Water Systems	320,100	15,786	1.3	49.3	7.5	X (1)		SEE VOLUME II, TAB C
Close Excess Window Openings	225,500	4,338	0.7	19.5	13.3	X (2)		SEE VOLUME II, TAB B
Energy Efficient Lighting	1,180,300	15,841	1.6	13.4	5.7	X		SEE VOLUME II. TAB F
Install Storm Windows	3,367,100	29,713	0.1	8.2	154.2		X	SEE VOLUME II, TAB A
Return Steam Condensate	30,899,000	231,199	0.7	7.4	13.3	X		SEE VOLUME II, TAB F
Install Economizers	72,600	100	-0-	1.4	330		X	SEE VOLUME II. TAB D
Cogeneration Plant	115,815,600	-751,120	0.6	-6.5	4.7		X	SEE VOLUME II, TAB D
Coal-Fired Boilers	42,297,541	7,270,000	-0.2	-0-	2.5	X		SEE VOLUME II, TAB E

PROJECTS FOR IMPLEMENTATION ON CURRENTLY ACTIVE BUILDINGS

PROJECT	$ COST	SAVINGS IN BTU 10^6	B/C RATIO	E/C RATIO	SIMPLE PAYBACK	RECOMMENDED	NOT RECOMMENDED	ACTION
Caulk & Weather Strip	178,206	22,527	3.3	126.4	2.9	X		Funding Applied for ECAM 1986
Steam Valves & Night Stats	118,800	7,516	1.5	63.3	6.2	X		Funding Applied For ECAM 1986
Insulate Domestic H.W. Systems	12,320	527	1.8	42.8	3.2	X(2)		Funding Applied For ECAM 1987
Insulate Buildings	507,100	19,054	1.0	37.6	9.8	X		Completed
Close Excess Window Openings	149,600	4,110	1.4	27.5	4.4	X(2)		Funding Applied for - ECAM 1987
Insulate Steam Mains	411,400	7,516	0.5	18.3	20.1	X		Funding Applied For - ECAM 1983
Return Steam Condensate	1,285,460	14,810	1.3	11.3	6.0	X(2)		Funding Applied For - ECAM 1987
Energy Efficient Lighting	137,500	631	0.5	4.6	16.8	X		Funding Applied For - ECAM 1986
Install Storm Windows (1)	506,000	2,322	0.0	4.6	333.8	X		Funding Applied For - ECAM 1986
Install Economizers	1,100	1	-0.2	.9	-64.7		X	
Convert Boilers to Gas	200,091	-0-	3.3	0.0	2.3	X		
Install EMCS	----	----	---	-----	----		X	See Volume I - Tab 6

(1) Vestibules will be installed as required, using O&M funding.

(2) Packaged for funding, see Volume I - Tab B.

ES-7.0 FUTURE EFFECTS ON ENERGY CONSUMPTION

ES-7.1 UNDER MOBILIZATION

Future energy consumption at Badger AAP will depend upon whether the plant is mobilized and to what degree, the effectiveness of the ECO's implemented, as well as changes in mission.

For the purposes of this study, it was assumed that the plant was fully mobilized and productive, and, therefore, energy consumption had increased 25 percent over the recent peak 1969 level. It was further assumed that the boiler plants were firing coal, and using oil as a standby fuel.

No new construction was anticipated. Under mobilization, there is no relationship to AFEP year 1985, or year 2000 energy goals, because no points of comparison are available to the 1975 base year, since the plant was inactive part of that year.

ES-7.2 UNDER CURRENT STATUS

Due to the fact that the plant was in partial production in 1975, (production ceased in June of that year), and on inactive status since, there has already been a dramatic drop in energy consumption.

BADGER AAP
BARABOO, WISCONSIN
EXECUTIVE SUMMARY

FISCAL YEAR 1985 GOALS:

1. Installation energy consumption has been reduced by more than 25%.*
2. Average annual energy consumption per GSF has been reduced by more than 20%.
3. No new buildings, that were part of the scope of this study, have been built and put into operation since 1975.
4. Reduction of dependence on critical fuels will be accomplished if the existing boilers are converted to coal firing.

FISCAL YEAR 2000 GOALS:

1. Installation energy consumption has already been reduced by over 50%.*
2. Coal-fired boilers will reduce dependence on critical fuels:
   A. Gas is not used at Badger. **
   B. If oil is used only as a standby fuel and to fire remote package boilers, consumption will be reduced by more than 75%.

* See Table ES-6, Page 23A
** See ECO-Appendix Volume I, Item C.

TABLE ES-6
ACTUAL FUEL CONSUMPTION

	TONS COAL (3)	GALLONS OIL	BTU X 10^6	KWH ELECTRICITY	BTU X 10^6	% OF 1975 BASE
FY68	157,855.7	-0-	3,157,114.0	84,492,640	980,114.2	---
FY69	219,955.4	-0-	4,399,108.0	115,536,800	1,340,226.9	---
FY70	188,465.2	-0-	3,769,304.0	96,799,600	1,122,878.8	---
(1)	Data Not Assimilated					
FY75 (2)	-0-	7,933,185	1,100,334.8	17,053,600	197,821.8	100
FY76	-0-	2,148,253	297,969.2	6,232,200	72,293.5	36.5
FY77	-0-	1,296,553	179,838.4	4,182,800	48,520.5	24.5
FY78	-0-	859,364	119,198.8	4,996,800	57,966.9	29.3
FY79	-0-	1,572,289	218,078.0	7,284,000	84,494.4	42.7
FY80	-0-	#2 566,832 #6 387,408	136,570.2	6,700,)00	77,720	39.3
FY81	-0-	#2 328,379 (4) #6 1,040,797	201,402.4	6,996,000	81,153.6	41.0
FY82	-0-	#2 51,600 #6 470,530	77,543.7	5,422,000	62,895.2	31.8

NOTES: (1) Boilers were converted to #2 fuel oil in 1972.

(2) All production ceased in 1975.

(3) Btu for coal is calculated at 10,000 Btus/lb.

#2 Fuel oil @ 138,700 Btu/Gal.

#6 Fuel oil @ 149,600 Btu/Gal.

Electricity @ 11,600 Btu/kwh

ES-8.0 SUMMARY

Under current inactive status, the only remaining step to meet AFEP, DOD energy conservation goals is to convert the plant to coal-fired operation to reduce dependence on critical fuels. Further significant energy conservation can be achieved, however, if the recommended projects are implemented.

Energy savings that would be realized at mobilization have no real point of comparison to FY 1975. For this reason, the "Baseline Usage" was established. Estimated and actual savings, assuming mobilization, could then be compared with this base.

BADGER AAP
BARABOO, WISCONSIN
EXECUTIVE SUMMARY

A P P E N D I X

ES-9.0

BADGER AAP
BARABOO, WISCONSIN
EXECUTIVE SUMMARY

EMCS EVALUATION

Several factors were incorporated into the preliminary study for evaluation and recommendation of an EMCS for Badger AAP:

1. The physical size of the facility spread over 7,000-plus acres.
2. The vast majority of buildings are heated only with steam fin-tube or radiation. The active buildings could be controlled more economically with night setback stats on control valves.
3. The few air conditioned or partially air conditioned active buildings, less than 5%, would be more economically controlled by time clocks or night stats.
4. The buildings would, under mobilization, be operated 24 hours a day.
5. Much equipment is currently missing, and it is impossible to determine exactly what would be installed at mobilization.

Because of the above factors, and the inactive status of the facility, a plant-wide EMCS could not be evaluated.

*

An EMCS for the few active buildings is not recommended, because of its high cost and minimum use factor coupled with minimal savings and a poor E/C ratio.

* There are at present 27 active buildings. Nine of these buildings are Well Houses and Sewage Treatment Buildings minimally heated with electric resistance heating.

Time clocks and night setback is, therefore, recommended for active buildings only, and incorporated in the ECOs evaluated.

BADGER AAP
BARABOO, WISCONSIN
EXECUTIVE SUMMARY

POWER FACTOR ADJUSTMENT

Power factor adjustment is not a feasible alternative for Badger. Analysis of recent utility bills, utility bills at mobilization, and the current rate structure reveals the follows:

1. Reactive Energy charges are applied only if the power factor is below 90%. Above 90% there is a credit.
2. Recent utility bills show only a very small charge or, often, a credit for Reactive Energy.
3. Utility bills from the 1960s and 70s, when the plant was in operation, show a power factor in the 86 to 88% range.
4. The savings that would result from power factor adjustment on active buildings would be insignificant when compared to the high installation cost.
5. The savings at mobilization would be minimal also, especially if newer, more efficient equipment and motors were installed. This could be evaluated at that time.

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EC RATION (REVISION)
82 15 [ARMY FACIL ENERGY PLAN]
83 14
84 13

SCOPE OF WORK
FOR
ENERGY ENGINEERING ANALYSIS (EEA) PROGRAM

BADGER ARMY AMMUNITION PLANT, WI;
~~CORNHUSKER ARMY AMMUNITION PLANT, NE~~

1. OBJECTIVES. The objectives of this contract are as follows:

1.1. Analyze the present energy usage and the present and future needs of the installation.

1.2. Identification and evaluation of energy conservation methods.

1.3. Develop energy conservation projects, prepare documentation and proposed scheduling. List and prioritize recommended energy conservation projects.

1.4. Determine the feasibility of converting existing oil fired boilers to coal.

1.5. Develop basewide facility systems modification plan for energy conservation projects.

~~1.6. Develop an installation energy management plan.~~

1.7. Prepare comprehensive installation energy report documenting study methods and results.

The long term objective is to implement a policy of becoming as energy self-sufficient as the state-of-the-art for energy conservation will allow within our resources and economic bounds set by the full implementation of our national energy policy as prescribed in The Army Facilities Energy Plan.

2. CONCEPT OF SCOPE ORGANIZATION.

2.1. It is anticipated that efforts under this Scope of Work will be performed for Badger Army Ammunition Plant ~~two installations~~ located in Wisconsin ~~and Nebraska~~ and that funds for these studies will be made available in increments and at varying times. Therefore, this Scope of Work is both flexible and adaptable to the ~~two military~~ installations and to incremental implementation.

2.2. The General Scope of Work is intended to apply to Badger A.A.P., WI. ~~these military installations~~ to be studied and to contain all general and common instructions and criteria. Detailed Scopes of Work for ~~each individual~~ the installation will be used to modify and amplify the General Scope of Work as required to make it applicable to the ~~specific~~ installation.

2.3. Since funding will be incremental, it is necessary that work to be performed under this scope be specified in increments. Work has therefore been divided into ~~six~~ four increments which briefly are: Increment A - ECIP projects for buildings and processes; Increment B - ECIP projects for utilities and energy distribution systems, Energy Monitoring and Control Systems (EMCS) and local use of available waste fuels in existing energy plants; incorporated into Increment A and B (Increment G) - Identify maintenance repair and minor construction projects for energy conservation in addition to ECIP projects; ~~Increment F - Develop an installation energy management plan; Increment C (As Option II) - Determine feasibility of new solar and renewable energy projects (an initial economic evaluation); Increment D (As Option III) - Determine feasibility of new total energy (TE) and selective (SE) plants.~~ Increment E ~~(As Option I) pertaining to Badger Army Ammunition Plant, WI, ONLY,~~ determine the feasibility of installing central boiler plants.

2.3.1 Phases. The work shall be accomplished in three phases.

2.3.1.1 Phase I - Consists of gathering data and inspection of facilities in the field. The ~~A-E~~ Contractor shall become thoroughly familiar with the ~~each~~ installation and undertake all necessary field trips to obtain required data. In addition to examination of physical facilities, plans, records and prior studies, the ~~A-E~~ contractor shall observe operating procedures and methods.

2.3.1.2 Phase II - Consists of analysis of data, performance of feasibility and economic studies, and identification of proposed projects. During this phase, all potential projects which produce energy and/or dollar savings should be identified and evaluated as to technical and economic feasibility.

2.3.1.3 Phase III - Consists of the final preparation of programming documents and reports presenting the results and recommendations of the study.

2.3.2. There is a requirement that programming documents on all designated energy conservation projects are to be submitted as early as possible.

It is anticipated that work at ~~these~~ the military installations and in all three phases will be performed simultaneously after sufficient Phase I activity has occurred to allow Phase II and Phase III activities to begin.

2.4. Prior to work commencement, a prenegotiation conference will be held at ~~each respective~~ the installation with representatives of the installation, Omaha District Corps of Engineers, the Contractor, and other key personnel.

3. GENERAL SCOPE OF WORK.

3.1. General.

3.1.1. A coordinated Basewide Energy System Plan shall be developed. This plan shall integrate the output of all energy conservation studies, projects or designs which have previously been prepared or will be prepared under this contract. It is desired that all methods of energy conservation which are reasonable, practical and economical be considered, including operational methods and procedures as well as physical facilities. It is not intended to prescribe the details in which the studies are to be conducted or limit the ~~A-E~~ contractor in the exercise of his professional engineering experience, good judgment or investigative ingenuity. However, the information and analysis outlined herein are considered to be minimal essentials for adequate performance of the study. The ~~A-E~~ contractor will review the data contained in DoD Construction Criteria Manual 4270.1-M, and other data contained in Annexes to this Scope of Work. The ~~A-E~~ contractor shall develop a comprehensive approach to energy usage in the most efficient and economical manner for the proposed construction projects and for conversion of existing systems.

The Army Facilities Energy Plan provides a checklist of energy conservation options.

3.1.2. The overall objective of this study is to produce a systematic plan of improvement projects that will reduce by 1985 the energy consumption in compliance with the Army Facilities Energy Plan without decreasing the readiness posture of the Army. All projects selected will be ranked in order of highest energy-to-cost ratio. Each project must amortize within and have a payback period of less than their economic life. Projects will be selected from this prioritized list for each fiscal year through 1987. Projects which will disrupt the occupancy of a facility shall be grouped together and performed at the same time, if economically feasible and practical.

3.1.3. This study shall include all energy consuming buildings and production processes except those that use very little energy (i.e., storage areas) and those that are to be demolished before FY 87. The work is reduced somewhat by building repetition, low energy use buildings and temporary buildings. The last, however, must be considered as having some extended use and will require coordination with demolition plans. Process systems energy savings (chemical studies-lowering temperatures, different chemicals, process, etc.) will <u>not</u> be studied.

3.1.4. The ~~A-E~~ contractor shall consider building upgrading, but only if this work is incidental to the energy savings improvement, i.e., a better finish insulated wall panel may be used in lieu of the more expensive

wall modification necessary to install insulation. Projects must meet ECIP criteria; building upgrading solely for appearance or similar consideration is not acceptable. Changes that should be made by Architect-Engineer or other organizations when designing new construction or modifying old construction that would minimize operating and maintenance cost of mechanical systems and minimize energy demand over the life of the facility shall be proposed.

3.1.5. In the course of field surveys, the ~~A-E~~ contractor shall document and report instances of waste in use and operation of facilities relative to energy consumption and shall recommend methods of reduction or elimination of these wastes, such as "provide operable windows," "abandon temporary building," or "convert temporary building room office to storage," "reduce excessive exhausting of conditioned air," etc., where it is an economically feasible and practical energy savings proposal. The ~~A-E~~ contractor should identify groups of buildings having centrally supplied heating and/or cooling in which energy consumption could be reduced by system or control revisions and make appropriate recommendations.

3.1.6. The "Energy Conservation Investment Program (ECIP) Guidance," dated 7 November 1977, gives instructions for performing the economic analyses, and "Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy and Heat Pump Systems," dated 1 July 1977, and changes thereto, give instructions for performing life cycle cost studies. The first addresses projected dates at the end of the fiscal year (FY) in which the project was programmed and the end of the FY minus one, while the latter addresses dates of mid-point of construction, beneficial occupancy date (BOD), and BOD plus six months as times to which various cost figures are to be escalated. Therefore, initially assume all improvement projects will be awarded in FY 85 (mid-point of construction about mid-point of FY 85, BOD about end of FY 86). After all studies have been made and the various proposed improvement projects appropriately ranked, ordered and scheduled, the economic and life cycle cost analyses will have to be corrected to reflect the actual award date, mid-point construction date and BOD anticipated by each installation. Only the corrected analyses will be included in the results of this study.

3.1.7. Current plans for use of energy must consider renewable energy sources with the objective of establishing an orderly procedure for reducing the use of nonrenewable energy sources. Renewable energy sources include such items as hydro, wind, solar, tide, and wave propagation. Refuse incineration could be considered a renewable energy source. Geothermal and nuclear sources, although not strictly renewable energy sources, should be considered among the alternatives.

3.1.8. Data for major installations, subinstallations, satellites, and off-post facilities shall be separately documented.

3.1.9. The study shall include storage, distribution, dispensing and use of all energy sources. The energy sources include electrical, natural gas, liquefied petroleum gas, bulk oil, other oil products, steam when procured, gasoline, coal, etc. Natural gas distribution systems capacity shall not be expanded without authority from the MACOM headquarters.

3.1.10. The storage and distribution of heating and cooling media such as steam, hot water, chilled water, etc., will be documented under heating as described in TB ENG 353. Provisions to increase storage capacity for peak cooling and heating periods will be a part of this study. The city planning technique described in TB should be used where applicable.

3.1.11. The study will encompass the future population to be served. Military Aggregate Strengths published for use in master planning will be expanded by including all other personnel served, i.e., employees of all agencies on post, civilians, NAF, all Contractor personnel employed on the post, etc., plus military dependents and transient quarters and guest facility occupants. Methodology use to compute the population over a 20-year period will be provided within the study.

3.1.12. Systematic conversion of gas-fired boilers to other more abundant fuel is required to improve reliability of fuel supply in the face of diminishing gas reserves and to conserve gas for small heating systems and appliances. Priorities for conversion should be established in the order of boiler size starting with largest boilers at top priority and scheduling down to 1,000,000 BTUH for completion by 1985 (fund availability permitting). Installations within a gas supply network having controlled or regulated consumption established by a state or Federal agency will program conversions to meet the agencies' prescribed requirements.

3.1.13. Conversions should include life cycle cost and energy source availability studies. Alternatives within these studies should include solar, geothermal, wind and heat pumps or combinations of the above. Specific attention is directed to ETL 1110-3-296 which modified DoD Construction Criteria Manual 4270.1-M.

3.1.14. Oil as an alternate fuel should only be considered for short range interim use since it will increase our dependence on foreign oil sources. Combination or dual fuel systems that allow use of the lowest cost fuel (energy source) available within the area

should be considered. Fuel blends which enhance calorific fuel value and reduce use of critical fuels should be considered, for example, suspension blending of five micron coal in fuel oil, etc. Use of liquefied petroleum gas (LPG) is prohibited in units larger than 750,000 BTUH. Its use is considered more critical than natural gas and should be reserved for small consumers that cannot economically be served by natural gas pipeline or other alternative fuels.

3.2. Project Management.

3.2.1. Project Manager. The ~~A-E~~ contractor shall designate a project manager to serve as a single point of contact and liaison for all work required under the contract. Upon the award of the contract, individual shall be immediately designated in writing.

3.2.2. District Office Project Manager. A project manager designated by the Contracting Officer will serve as the point of contact within the Omaha District Office.

3.2.3. Installation Assistance. A project engineer designated by the Commanding Officer at each installation will serve as the point of contact for obtaining available information and assisting in establishing contacts with the proper individuals and organizations as necessary in the accomplishment of the work required under this contract.

3.2.4. Public Disclosures. The ~~A-E~~ contractor shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.2.5. Conferences. ~~Periodic meetings shall~~ Conferences may be scheduled whenever requested by the ~~A-E or~~ contractor and approved by the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The ~~A-E and/or the~~ contractor's appropriate representatives(s) shall be required to attend and participate in all conferences pertinent to the work required under this contract as directed by the Contracting Officer. All resulting travel costs and expenses incurred for these conferences will be paid for in accordance with Article 3B of the Articles of Service.

3.2.6. Site Visits, Inspections, and Investigations. The ~~A-E~~ contractor, consultants, if applicable, and/or designated representative(s) thereof shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work. All resulting travel costs and expenses incurred are included in the lump sum price of the contract.

3.2.7. Records. The ~~A-E~~ contractor shall be required to maintain and provide upon request a record of all communications relative to this contract in which the ~~A-E~~ contractor and/or the designated representative(s) participated.

3.2.7.1. The ~~A-E~~ contractor shall be required to provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., relative to this contract in which the ~~A-E~~ contractor and/or designated representatives thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The ~~A-E~~ contractor shall forward to the Contracting Office, as soon as possible (not to exceed ten (10) calendar days) a reproducible copy of the records.

3.2.7.2. The ~~A-E~~ contractor shall be required to provide a record of requests for and/or receipt of Government-furnished material, supplies, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The ~~A-E~~ contractor shall forward to the Contracting Officer, as soon as possible (not to exceed ten (10) calendar days), a reproducible copy of the record of receipt.

3.3. Services and Materials. All services, supplies, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

3.4. Phases of Work.

3.4.1. Phase 1 shall consist of gathering data and inspection of facilities in the field. These activities must be closely coordinated with the District Engineer, the Installation Commanders and the Facilities and Plant Engineers. In addition to examination of physical facilities, plans, records and prior studies, the Contractor shall observe operating procedures and methods. Data sources should be identified and assumptions clearly stated and, if necessary, adequately justified.

3.4.1.1. The ~~A-E~~ contractor shall compile quantitative lists of all raw energy consumed annually, and population and facilities served thereby, as related to and required for energy analysis, to include, but not limited to:

a. Production cycles.

b. KW hours of electricity and peak demands .

c. Therms of gas by type (NG, LNG, propane, etc.).

d. Gallons of oil by grade.

e. Other, if any (such as purchased steam, chilled water, coal, refuse derived and waste oil fuel, etc.).

f. Personnel and building occupancies.

g. Weather data.

3.4.1.2. The ~~A-E~~ contractor shall become thoroughly familiar with each installation and undertake all necessary field trips to obtain required data. Where there are a number of similarly constructed buildings performing the same function, a representative sample may be analyzed. Proposed future construction through FY 87 shall be considered. Buildings shall be listed and identified by the installation's numbering system and also by function and title. The building list shall contain items relating to and required for energy analysis and shall include, but not limited to:

a. Square footage of floor area (heated and/or air conditioned space).

b. Type of construction and "U" values.

c. Window area and door openings (include dock doors).

d. Type and capacity of HVAC systems.

e. Type and capacity of domestic water and process water heating systems.

f. Building heat gain and heat loss.

g. Types of energy entering the buildings with estimated or metered consumption expressed in BTU for development of load profiles.

h. Estimated or documented electrical demand (KW) and electrical energy consumption (KWH/yr.).

i. Process energy systems.

3.4.2. Phase II shall consist of analysis of data, performance of feasibility and economic studies, and identification of proposed projects. During this phase, all potential projects which produce energy and/or dollar savings should be identified and evaluated as to technical and economic feasibility. Projects determined to be technically and economically feasible shall be integrated into a Basewide Energy System Plan. This plan shall have all individual projects ranked in order for programming consideration of choices. Criteria for ranking of projects is established herein.

3.4.3. Phase III shall consist of the preparation of the programming documents and reports presenting the results and recommendations of the study for each installation.

3.5. Increments of Work.

3.5.1. Increment A involves modifying, improving or retrofitting existing buildings, and energy distribution systems, and mechanical plants to include architectural and structural features, HVAC systems, solar systems, plumbing systems, interior or exterior building and parking facilities lighting. Projects shall be economically evaluated in accordance with provided ECIP criteria.

3.5.1.1. Survey. Each type of building or discrete part thereof shall be analyzed in terms of its energy consumption and load profile. List all buildings by type of function (barracks, warehouse, office, etc.) and identify specific characteristics affecting rate of energy consumption. Show "U" value for each major building component, i.e., roof, ceiling, exterior walls, floor, windows and doors. Show window to floor area ratio. Show building heat gain, if air conditioned, and heat loss, if heated, in terms of BTUH at the design temperature differential. Identify the ratio of window load to total load. Each architectural and structural element, and each functional activity and process should be identified and its effect on the building energy consumption established. In order to accomplish this, population levels, functional activities and durations, historical and concurrent dry and wet bulb temperatures, etc., must be determined, and electrical demand and consumption shall be estimated and load curves developed.

3.5.1.2. Evaluations. Identify each energy source entering the building, the BTUs of each energy source (in Mega BTU) consumed per year, the media and BTUs used for domestic water heating, the media and BTUs used for comfort heating, the media and BTUs used for comfort cooling, the devices used to condition the media, type of system transporting media with heat exchanger surface (four pipe, fan coil; gas, duct, hot air; two pipe radiator; duct, DX coil, etc.), and storage capacity for fuels and media such as chilled water or hot water for heat sink solar and heat pump system. Electrical demand and consumption shall be estimated and load curves developed. An energy (or heat) balance shall be developed for each type of building at times of maximum usage or crucial functional activity. Identify building or equipment changes or modifications that would minimize energy demands in existing facilities for the life of the building not to exceed 25 years. Provide firm data to support recommendations.

3.5.1.3. Recommendations. The basic objectives of this part of the study are to collect and present in tabular and/or graphic form a complete energy consumption picture of the entire base under designated

operating procedures and conditions. Planned physical plant expansion with its expected population growth shall be included. The ~~A-E~~ contractor shall analyze each element of an energy balance statement and make specific recommendations for improving performance. Studies shall ecompass operational procedures of facilities to establish an ability to administer controls to conserve energy. Changes to use remote sensors and thermostats in mechanical rooms or control of return air could prove fruitful. Proposals which would be technically and economically feasible but which would hinder or obstruct functional activities should be flagged for early resolution. Changes in system temperatures and flow rates should be identified and evaluated.

Heat pump systems should be considered where there is a simultaneous requirement for both heating and cooling in a building or buildings in close proximity of one another. Present systems and procedures which are inefficient and energy intensive should be identified and recommendations made for correction.

3.5.1.4. As a portion of Increment A, the ~~A-E~~ contractor shall evaluate facilities which are determined to have high energy consumption to determine which would benefit from the installation of appropriate types of meters. The resulting recommendation shall include location by building number, and sizes and types of meter to be installed. These facilities will include, but not be limited to family housing, production, maintenance, storage and administration buildings.

'B'

3.5.2. Increment B projects involve utilities and energy distribution systems, EMCS for building and distribution systems, and conversion of existing energy plants. Projects shall be economically evaluated in accordance with ECIP criteria.

3.5.2.1. Systems to be studied will include electrical supply and distribution systems; steam, chilled water and hot water distribution systems including wells, pumps, storage and treatment facilities; and sewage collection and treatment facilities which are maintained and operated by the installation. Quantitative analyses of all energy distribution systems shall be made. Efficiency or coefficients of performance should be determined for each type of system, i.e., the ratio of energy (or fuel) input to energy use or rejection. If possible, load profiles for each type of system should be developed reflecting annual, monthly, weekly, daily and hourly consumption as appropriate. Projects will be economically evaluated in accordance with instructions provided. The information obtained from the survey of existing and proposed facilities will be used to the fullest possible extent in developing the requirements the EMCS.

3.5.2.2 Develop a load profile by year for the past three years for each energy source procured (heating oil, natural gas, LP,

electrical). Using data from the past 12 months, separate and identify the nonreimbursable loads using a list of reimbursable fund loads furnished by the installation, and then identify the peak demand loads, essential loads, and unnecessary loads. The reimbursable fund loads should be further separated to contain nonappropriated fund type facilities, housing, and other as defined by the Facilities Engineer. The data should be further modified to include all future facilities documented in the installation master plan. The load profile charts with supporting data will be submitted for review by the Government. The accuracy of these time related charts will influence the final recommendations made by the Contractor.

3.5.2.3. Project energy costs three years from date of contract award and develop heating and cooling costs and lighting and other loads per square foot per year.

3.5.2.4. Energy Monitoring and Control System (EMCS). The ~~A-E~~ contractor shall determine the feasibility of an EMCS for building electrical, mechanical and utility distribution systems.

3.5.2.4.1. The ~~A-E~~ contractor shall survey all buildings in accordance with guidance in HNDSP-80-013-ED-ME.

3.5.2.4.2. Analysis and Evaluations. The ~~A-E~~ contractor shall perform feasibility evaluations in accordance with guidance in HNDSP-80-013-ED-ME. EMCS analysis and evaluations shall be developed using TM 5-815-2. Any existing EMCS project or any currently under study shall be considered and evaluated for integration. EMCS evaluations shall consider but not be limited to the following features.

a. Start/stop Programs.
   Scheduling.
   Duty cycling.
   Load shedding for electrical demand limiting lighting control.
   Start/stop Optimization.

b. Ventilation and Recirculation Program.
   Enthalpy economizer.
   Dry bulb economizer.
   Outside air reduction.

c. Temperature Reset Programs.
   Space temperature night setback.
   Hot and cold deck.
   Reheat coil.
   Chilled water.
   Chiller plant optimization.

3.5.2.4.3. Recommendations. The ~~A-E~~ Contractor's recommendations for an EMCS shall be in sufficient detail to define the system configuration, control instruments, sensors, and data transmission system. The selection of points to be monitored and controlled shall be given priority based upon ECIP criteria. Development of cost for an EMCS shall include the cost for providing one pair of telephone lines to each building selected. The control system functions, expected energy reduction, and monetary savings (including the manner in which these savings are to be achieved) shall be explained.

3.5.2.4.4. Products.

a. Reports. The ~~A-E~~ contractor shall prepare and provide recommendations in narrative form to define the requirements of paragraph 3.5.2.4.3. above.

b. Input/Output (I/O) point selection estimate. The ~~A-E~~ contractor shall prepare and provide I/O summary tables for each system selected in EMCS in accordance with HNDSP-80-013-ED-ME.

c. Cost Estimates. The ~~A-E~~ contractor shall prepare and provide cost estimates in accordance with HNDSP-80-013-ED-ME (Table II) for the mechanical and electrical modifications required to implement the EMCS.

d. Programming Documents. When the EMCS meets the ECIP criteria, the A-E shall prepare programming documents.

3.5.2.5. Existing energy plants shall be studied to determine the condition of existing equipment, efficiency of the plant equipment, operational procedures, adequacy of plant capacity, etc. Recommended modifications will be determined including the possibility of utilizing wood, coal, and refuse derived fuels. Only refuse generated on the base will be considered. No purchase or collection of refuse or waste from surrounding communities or areas is anticipated.

3.5.2.6. As a result of the data gathered and analyzed, the ~~A-E~~ contractor shall develop graphic presentations, i.e., graphs, charts, etc., depicting the hourly kilowatt demand for peak load/demand days for each type of building area with the exception of those which have little or no loads. This data shall be utilized to develop procedures to reduce the peak demand and accommodate load shedding. Savings in dollars and kilowatt hours shall be presented in the study report.

G

3.5.3. Increment G - (Incorporate into Increment A and B). Identify maintenance, repair and minor construction projects for energy conservation in addition to ECIP projects.

3.5.3.1. Identification of maintenance, repair and minor construction projects for energy conservation will be accomplished during Phase I and Phase II of Increments A and B. These projects will be energy saving projects which do not qualify under the ECIP criteria. All projects including low cost items will be documented based on energy savings, energy/cost ratio, cost/benefit ratio, manhours to accomplish project and estimated cost. Projects will be listed by priority order on cost/benefit ratio.

3.5.3.2. Economic analysis will be based on ECIP procedures. DD Form 1391 and Project Development Brochures (PDB) will not be required for minor construction projects. However, the report shall contain sufficient data and present the information so as to permit the installation to easily produce these programming documents, if so desired, by extracting technical and economic data and updating the economic evaluations. The requirements of AR 415-35 shall be followed for minor construction projects. For maintenance and repair projects, the requirements of DA Pamphlet 420-6 and AR 420-10 will be followed. For these projects adequate data will be included in the report so that the installation can easily prepare work orders or local projects for contract accomplishment.

3.5.4. Increment F - Energy Management Plan. Develop an Energy Management Plan (EMP) for each installation by analyzing all the installation's energy uses and needs, not only the energy uses by the physical facility plant in supporting the operational mission of the installation, but by analyzing the energy requirements of viable alternative operation activities and uses of the physical plant. The installation's physical plant will be considered in detail - and how energy is supplied to and used by the physical plant. The EMP when developed and approved will be documented plans of action which will include and define:

Changes in operation which will achieve a lower energy use.

Consolidations of facility uses, facility deactivations, and schedules of multiple-uses of facilities.

Program of prioritized ECIP projects.

Program of low capital cost energy conservation projects which can be accomplished by technicians.

Program of energy conservation goals for each unit on the installation.

A continuing program of energy conservation education, information, and training for all post occupants.

A program of facility plant operations and maintenance which emphasizes preventive maintenance of primary energy conservation and supply equipments and control systems.

3.5.4.1. The work will consist of two phases (Phase 1 and Phase 2).

3.5.4.2. Phase 1. The development of the EMP requires that the ~~A-E~~ contractor coordinate activities directly related to the structuring of the EMP with the major Army commands (MACOM's), representatives of the Commanding General, Installation Commanders, Mission Commanders, Facility Engineers and Facility Energy Conservation Council (FECC). (See Army Facilities Energy Plan, 1 Oct 78). The plan for development of the EMP will be presented in writing to the MACOM, Installation Commander, FECC and Contracting Officer for review and a single briefing will be presented by the ~~A-E~~ contractor to clarify the development plan. After review and comment by all of the above parties, the ~~A-E~~ contractor shall prepare a final development plan of the EMP for review and comment by the above parties. At the mid-point of the development of the EMP a draft EMP will be submitted for review and comment prior to finalizing the EMP.

a. Initial Development Activities.

(1) Secure, analyze and evaluate all data obtained from the EEA study just completed and from previous energy studies including any suggestions for management actions.

(2) Evaluate the installation master plan and all short range program plans.

(3) Evaluate all post energy consumption data, utility contracts, and stated future requirements.

(4) Develop firm plan of action.

b. EMP Development Activities.

(1) Facility Plant Operation.

(a) Identify and evaluate utility plant operation on a real time annual basis, status of control systems, maintenance operations, real time uses of energy-fuel conversions, and perform additional metering if necessary.

(b) Identify and evaluate alternative preventive maintenance schedules for major energy conversion and supply systems.

(2) Operational Planning. This activity will be performed in association with representatives of Facilities Engineer and assigned mission representatives.

(a) Identify the operational plan for each mission element on a real time basis.

(b) Identify the mission support activities needed on a real time annual basis.

(3) Facilities Utilization.

(a) Identify for such major facility the utilization schedule for each operational mission activity on a real time annual basis, including numbers of mission people involved, numbers of support people, and actual uses of energy.

(b) Identify by operational mission on an annual basis, the real time use of energy separately identifying the mission facilities and mission support facilities involved.

(4) Training and Public Information. This activity will be performed in association with representatives of the Facilities Engineer and assigned PIO representatives. Based upon types of mission activities which can be practiced by all "residents" of the installation. Identify courses, literature requirements, and personnel requirements.

(5) Energy Conservation Initiatives.

(a) Identify and evaluate low-cost and no capital cost (labor only) energy conservation measures.

(b) Identify funding for work orders, local material requirements and supply, self-help materials and plan for use.

c. Development of the overall Energy Management Plan.

(1) Physical Facility Plant.

(a) Prepare preventive maintenance plans.

(b) Prepare plan to implement ECIP projects developed in the EEAP including project priorities and scheduling and new DA 1391's and project development brochures (PDB) if necessary.

(c) Integrate new and existing operational and control plans for fixed facility systems: buildings, energy plants, and industrial type processes.

(d) Prepare program plan for accomplishment of no-cost/low-cost energy conservation initiatives, defining by priority order on cost/benefit ratio.

(2) Mission Operation Activities.

(a) Prepare mission operation recommendation.

(b) Prepare facility consolidation utilization recommendations, including cross-uses.

(c) Prepare recommended management action energy, use reduction measures for units - activities.

(3) Training and Public Information. Prepare recommended program of public education and information concerning energy conservation to include lectures, seminars, pamphlets, etc., with both required and optional participation.

(4) Develop draft Energy Management Plan.

(5) Brief Installation Commander/MACOM/FECC/Contracting Officer.

3.5.4.3. Phase 2. Implementation of the Energy Management Plan. After the approved EMP is developed, an implementation schedule will be developed. The contractor will provide classroom and written instructions to Government representatives on implementing the EMP. The contractor will be available to aid in the implementing of the EMP if requested and funded by the Installation Commander.

3.5.5. Increment C projects involve new solar and renewable energy projects, except those proposed in conjunction with a feasible ECIP project for existing and proposed facilities. These studies are to determine the feasibility of utilizing solar and other renewable energy sources for space heating, space cooling, domestic hot water or process heat, or combinations thereof, as defined by the payback period within the economic life of the facility derived from the life cycle cost analyses.

3.5.5.1 Survey of potential usage of solar systems will be made in conjunction with the energy requirements for various building types for the winter, spring, summer and fall season. Solar systems to be considered are those which have been installed and proven elsewhere and for which some operating and maintenance experience has been obtained. These systems include solar heated domestic hot water (preheating or full heating kitchen supply up to 180 degrees F and other domestic hot water at 100 degrees F), solar assisted heat pumps, solar collector/storage systems for space heating and cooling, and solar steam generation for process heat.

3.5.5.1.1. Conceptual designs will be generated for a number of typical installations for localized usage at each of the building types at each of the facilities. The building types will include dormitory units, and swimming pools, mess halls, maintenance shops and office buildings. The conceptual design will be based on solar collectors being located at the particular building where the collected energy will be used. The availability of mounting space for the solar collectors will be studied and location of each collector field will be specified in conceptual design.

3.5.5.1.2. Each proposed solar collector installation will be evaluated in accordance with Engineer Technical Letter 1110-3-302, dated 14 March 1979, and payback periods with and without maintenance costs will be determined. Credit for operation and maintenance cost savings will be given to any solar system if the system would be capable of supplying all thermal energy requirements for an area during the summer season so that a boiler plant could be shut down and the distribution system deactivated. Operating and maintenance costs and expected life of the installation will be determined for each system based on experience of similar existing systems. Equipment, material and installation costs for each solar system will be estimated.

3.5.5.1.3. Impact of solar systems on the Basewide Energy System Plan will be studied, based on the installation of solar systems having a range of payback periods, all to be less than the projected useful life of the facility served. All items with payback periods of 11 through 20 years shall be listed and cost estimates shall be provided for items with payback periods of 11 through 15 years.

3.5.5.2. Renewable energy sources. List and briefly describe each renewable energy source available to the installation. Describe any modifications required to the existing generation and distribution systems for cooling and heating media to adapt them to recommended renewable energy sources.

3.5.6. Increment D Projects. Determine the feasibility of new Total Energy (TE) and Selective Energy (SE) plants utilizing solid and/or oil fuels, supplemented, as feasible, with refuse derived fuels and waste oil fuels. This study shall be performed for the entire installation to include family housing.

3.5.6.1. A study shall be made to determine the feasibility of installing electrical generating equipment to supply all or discrete parts of the installation's electrical demands and at the same time use the rejected heat from electrical generation to supply thermal needs of the installation. The primary objective is to reduce energy consumption through the capture and reuse of energy presently being wasted. The proposed electrical system should be examined both as an independent system and as one operating in parallel with the local utility company.

~~Rejected energy shall include utility company generating and trans-~~ mission losses. The study shall assume that all practicable energy conservation measures, and those which have higher priority in the Basewide Energy System Plan, will have been accomplished. The thermal and electrical demand information obtained from the survey of existing and proposed facilities and from the study of EMCS will be used to the fullest possible extent in preparing the Total Energy and Selective Energy Studies. The studies shall be applicable to each installation and will include the entire installation, with the concept of constructing either one TE or SE plant for the installation or constructing smaller TE or SE plants on a regional basis throughout the installation. "Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy and Heat Pump Systems," (EI) dated 1 July 1977, shall be followed to the fullest possible extent, except for the following:

a. Only TE and SE are applicable for this study.

b. Fuel source will be coal, wood and/or oil. All fuels will be estimated. Oil shall be secondary fuel to coal. Waste oil and/or refuse derived fuels may be used as supplemental fuels if technically and economically feasible.

c. In addition to the study procedures and requirements contained in the EI, the feasibility study report will contain the following:

(1) Provide a comparison of thermal energy and electrical energy usage between the conventional (with ECIP and EMCS projects) and proposed TE and SE plant(s). The type of fuel used by the local utility in generating commercial power shall be included.

(2) Peak electrical load or demand.

(3) Electrical energy used KWH/yr.

(4) Heating energy - BTU/yr.

(5) Cooling energy - BTU/yr.

(6) Waste heat available - BTU/yr.

(7) Waste heat used - BTU/yr.

(8) Percentage of waste heat used.

Recommendations resulting from these studies shall be made. Recommendations shall include single line drawings of those projects determined feasible. Development of programming documents are required (DD Forms 1391 and PDBs).

3.5.6.2. A study shall be made of the use of materials as fuel for energy conservation. The objective of this study is to determine the feasibility of waste energy conversion in terms of a Life-Cycle Cost Analysis.

3.5.6.2.1. Assessment of Available Wastes. Initially, a survey will be made of each installation as to the quantities and types of waste being disposed of and the cost of collection and disposal. This survey will determine the relative amounts of recoverable scrap materials, combustibles and noncombustibles. In addition, the survey will determine the monthly profile of the availability of the usable wastes throughout the year. The survey will also obtain a projection of population growth for the base for the next 15 to 25 years. Future anticipated collection costs will be determined. The possibility of participating in regional refuse derived fuel (RDF) plants owned and operated by others will be investigated.

3.5.6.2.2. Development of Site Adapted Plant Concepts. There are two general concepts of plants in operation today for the incineration of solid wastes: Water wall incineration (mass burning or supplemental firing of boilers) and pyrolysis. Both concepts will be evaluated for adapting them to the site-specific requirements of each facility. General characteristics of the two plant concepts are listed:

a. Water Wall Incineration. A water wall incineration plant is a steam-generating plant with some type of stoker fuel feed. Preprocessing of solid wastes generally consists of removal of undesirable bulky items, shredding and separation of noncombustibles from combustibles. An electrostatic precipitator is generally the only environmental pollution abatement device required for the plant.

b. Pyrolysis. An incineration plant utilizing the pyrolysis concept limits the combustion of the fuel with insufficient oxygen in a pressurized pyrolysis chamber to produce a combustible gas of approximately 350 BTU/SCF. Preprocessing the incoming solid waste permits removal of ferrous materials and shreds the remaining refuse to homogenize the bulk and moisture variations in fuel. The combustible gas requires scrubbing and possible drying before it can be piped to existing gas-fired boilers which must have burner air/fuel ratio modifications. The only environmental pollution abatement treatment which must be used is treatment of contaminated gas scrubbing water.

3.5.6.2.3. Evaluation of Concepts. The procedure for evaluating each plant concept includes determination of optimum commercial plant size for the available and future solid wastes, analysis of energy requirements for each facility with utilization of plant-generated steam or 350 BTU/SCF gas and the life-cycle cost analysis described below.

3.5.6.2.4. Life-Cycle Cost Analysis. The feasibility of solid waste utilization as an energy resource and the subsequent selection of the plant concept will be determined by the "payback periods" as obtained from the life-cycle cost analyses of the two concepts. The cost of separation, transportation and sale shall be determined for each marketable item. The tonnage of each marketable item shall be determined for use in the base life-cycle cost analysis. Elements to be derived for these analyses are:

a. Capital equipment cost will be estimated for the size of plant designed to process available solid wastes anticipated in the year 1985 with capability for expansion.

b. Operating and maintenance costs will be derived for manpower and materials for each of the plant concepts. Operating costs will also include the costs of solid waste collection, electrical power for auxiliaries of the plant, water for scrubbing or material handling and disposal of solid residues.

c. Revenues for the plants will be calculated for the value of the generated steam or the 350 BTU/SCF gas and the recovered scrap metals.

d. Life of the plant will be extrapolated from operational data and maintenance experience of existing plants.

3.5.6.3. The study will recognize and evaluate the costs of providing adequate commercial standby capacity.

3.5.7. Increment E, Central Boiler Plant Projects ~~(As an Option)~~. Determine the feasibility of installing central boiler plants serving all or discrete parts of the Badger AAP, WI ~~ONLY~~.

3.5.7.1. A study shall be made to determine the practicability and economic feasibility of constructing central boiler plants to supply steam or high temperature water, as applicable, to all or discrete parts of each military base. The primary objective is to reduce the dependency on petroleum fuels by changing to coal or other solid fuels as the primary fuel with oil as the backup or secondary fuel. The use of solid fuel such as refuse derived fuels, and wood as a fuel or as a supplemental fuel to coal shall be considered. Existing distribution and building systems will be utilized to the maximum practical extent. The study shall assume that all practical energy conservation measures developed by the Basewide Energy Studies would have been accomplished except for TE and SE plants. The study shall include site recommendations and shall consider sources of refuse derived fuels, wood, and coal supply, transportation methods, fuel handling and storage and pollution control methods.

3.5.7.2. Economic Analysis shall be based upon life cycle costing procedures used for TE and SE plant analysis. Any savings or increase in energy consumption shall be documented. The condition and life expectancy of existing central boiler plants shall be considered and documented. DD Form 1391 or PDB will not be required. However, the report shall contain sufficient data and present the information so as to permit the installation to easily produce these programming documents, if so desired, by extracting technical and economic data and updating the economic evaluations.

4. DETAILED SCOPES OF WORK.

4.1. The above General Scope of Work is intended to apply to contract efforts for both military installations included under this contract except as modified by attached Detailed Scope of Work for each individual installation. Should conflicts occur between the General Scope of Work and the Detailed Scope of Work for any installation, the Detailed Scope of Work shall govern.

4.2. Detailed Scopes of Work are included as follows:

a. Badger Army Ammunition Plant, Wisconsin; Annex A

~~b. Cornhucker Army Ammunition Plant, Nebraska; Annex B~~

4.3. Inclosure 1 graphically illustrates the Scope of Work for each installation.

5. SUBMITTAL OF DATA.

5.1. Preparation of Documents. The following documents shall be prepared for each installation.

5.1.1. Interim Reports. Interim reports shall be prepared in a brief and informal manner. Copies shall be prepared in a format suitable for the purposes of the presentation conducted by the ~~A-E~~ contractor. The purpose of the interim report is to provide each installation with pertinent data concerning energy usage and energy conservation methods that are appliable to short-range planning. The interim report shall be prepared and submitted at the completion of work on Increments A and B. This report should contain a narrative summary of the conclusions and recommendations together with all raw and supporting data, methods used and sources of information. Copies of DD Forms 1391 with supporting data will be submitted at the same time as the report and as a part of the report. The summary shall include the order of priority in which the recommended tasks should be accomplished. Previous energy-related 1391s shall be tabulated showing expected contribution.

5.1.2. Formal Reports/Tabular Data. Formal narrative and tabular data shall be typed and printed on 8-1/2" x 11" sheets with fold-outs for maps, sketches, schematics, charts, graphs and other illustrative material, as necessary. Generally, all formal narrative text shall be typed in lines perpendicular to the longest axis of the sheet. Data which cannot be clearly described in narrative form shall be graphically shown. Formal documents shall be securely bound with hard paper or a flexible material in a durable and attractive manner. The title of the document shall appear on the cover of all submittal documents. All final documents shall be bound in a manner which will facilitate repeated disassembly and reassembly, and the title shall appear on the bound edge, in a secure manner, as well as the cover. Narrative contents of the document(s) shall be arranged in a logical sequence and organized by sections, unless otherwise specified. Pages, paragraphs, charts and graphs will be numbered. References to information contained elsewhere within the contents of the document(s) shall be properly noted. All data sources used in preparing the information presented in the document(s) shall be appropriately referenced. Tabs and/or dividers shall clearly and distinctly divide sections, subsections and appendices. Tabs and/or dividers shall clearly and distinctly divide sections, subsections and appendices.

5.1.3. Programming Documents. Military Construction Project Data (DD Forms 1391), supporting documentation and Project Development Brochures shall be prepared as required. Early identification of feasible projects and development of the corresponding DD Forms 1391 are essential and shall be accomplished as required by this Scope of Work. DD Forms 1391, supporting documentation and Project Development Brochures shall be submitted simultaneously, in accordance with the required submittal schedule.

5.1.3.1. Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and supplemental requirements as stated in this Scope of Work. These forms shall be separate from the report. They shall be bound similarly to the report in a manner which will facilitate repeated disassembly and reassembly. A complete DD Form 1391 shall be prepared for each project. Documents shall be complete as per requirements of submission to higher Department of Army headquarters. These programming documents will require signatures by the proper installation officials prior to submittal of the required quantities. Preparation of DD Form 1391 requires completion of a concise summary form outlining the project description, project cost estimate and the basis for implementation of the project. This summary form also requires information specifying the agency in charge of the project, the location of the project, assignment of a project number and the fiscal year for implementing the project. To support the summary form, specific project data is required in accordance with AR 415-15 and as follows:

a. The ~~A-E~~ contractor shall develop an expanded general description of the project and state the projected savings achievable (energy and dollars).

b. A description of the present accommodations in use shall be included in contrast with the proposed project.

c. Provide a brief analysis of the deficiency of the existing accommodations including description of projected savings in energy.

d. Include a description of alternatives to the existing system and indicate reasons for selecting the proposed alternative.

e. State the proposed criteria including specific reference documents for the project.

f. Indicate a program for furnishing equipment and installing the equipment for the project. Include requirements for Government and ~~A-E~~ contractor furnished items and coordination efforts required.

g. Describe efforts required for disposal of present assets if so required by the projects. Distinguish between ~~A-E~~ contractor and Government items.

h. State requirements for inclusion of survival measures in the project if applicable.

i. Include a brief assessment of environmental consequences of the project.

j. Include evaluation of potential flood hazards.

k. Include a detailed economic savings analysis outlining annual energy savings, operation and maintenance reductions, investment costs, escalation in energy costs, life cycle costs and savings/investment ratio or cost/benefit analysis in accordance with furnished guidance.

l. Indicate additional utility requirements necessary to support the project.

m. Review the project for historical and/or cultural impact in accordance with TM 5-801-1, PL 89-655 and Executive Order 11593 as required.

n. Prepare an energy requirement analysis outlining energy sources, energy alternatives, energy consumption and conservation.

o. Include analysis of provisions for handicapped in accordance with PL 90-489.

p. The last line of block 25 shall indicate the annual dollars savings, annual MEGA BTU savings and amortization period in years.

5.1.3.2. Project Development Brochures: Preparation of Project Development Brochures requires the ~~A-E~~ contractor to delineate the functional requirements of the project as related to the specific site. The brochure is required in support of DD Forms 1391 when the project is placed in the Short Range Construction Program. The ~~A-E~~ contractor shall complete all data as required by TM 5-800-3, Program Development Brochure. A descriptive narrative outlining the general nature of the project and the functional use of the project will be developed. Following this narrative, the information required to achieve a conceptual design of the project will be described on the Appendix "A" forms. This data will include present and future design considerations.

5.2. Presentation and Submittals. The ~~A-E~~ contractor shall give a brief presentation of each submittal before assembled installation, command and other key personnel, utilizing visual exhibits whenever ~~possible at a time~~ directed in writing by the Contracting Officer. A comprehensive review of the report will be conducted immediately following the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. It is anticipated that each presentation will last for approximately three hours, including questions and answers. The presentation will be on date(s) and at location(s) ~~agreeable to A-E~~ directed by ~~and~~ Contracting Officer. All resulting travel costs and expenses incurred for these presentations will be paid for in accordance with Article 8B of the Articles of Service

5.2.1. Preliminary Submittal. The ~~A-E~~ contractor shall prepare and submit the preliminary submittal at the completion of Phase I of each increment. The purpose of this submittal is to insure that the work is being performed on schedule. The ~~A-E~~ contractor shall indicate what actions have been accomplished to date, the methods of approach utilized, progress to date, and justifications for the studies and approaches; reveal problems encountered or resulting from the survey; present information the Contractor considers pertinent; and obtain approval or redirection of the study as required. This submittal shall contain (a) narrative summary of the conclusions and recommendations; (b) all raw and supporting data; (c) methods used; and (d) source of information. The summary shall include the order of priority in which the recommended tasks should be accomplished. Proposed format and arrangement of the interim submittal shall also be submitted for approval by the Contracting Officer.

5.2.2. Interim Submittal. The ~~A-E~~ contractor shall prepare and submit the interim submittal upon completion of Phase II of each increment. Formal documents are required for this submittal. The purpose of this submittal is similar to that of the preliminary submittal. The ~~A-E~~ contractor shall separately identify feasible projects meeting ECIP criteria complete with programming documents for proposed packaged projects.

Previous energy-related 1391's shall be tabulated showing expected contribution. During the review period, the Contracting Officer will coordinate with installation and MACOM representatives and provide the ~~A-E~~ contractor with direction for packaging projects for programming purposes.

5.2.3. Prefinal Submittal. The ~~A-E~~ contractor shall prepare and submit the prefinal submittal essentially (90%) of all work under this contract is complete. Formal documents are required for this submittal. The report shall be a basewide energy conservation study and system plan which integrates all aspects of the study. Revised completed program documents from the previous submittal shall be submitted when required by an increment. The program documents shall be complete and ready for signature by the installation commander. The original programming documents shall be submitted to the Contracting Officer's representative for further distribution and action. The final submittal with the exception of the programming documents will serve as a basis for review and comment to ensure the deliverables provided under this contract meet the criteria and standards set forth by this scope of work and the Contracting Officer's directions, and shall contain all data required by this scope of work.

5.2.4. Final Report. The ~~A-E~~ contractor shall submit the final formal documents when the required work and documents are 100% complete. The final documents shall incorporate all changes resulting from the previous submittal and associated reviews. DD Form 1391 and criteria shall be submitted as part of the final submittal. The report shall cover the entire scope of the study and shall include the order of priority in which the recommended tasks shall be accomplished. Due to the volume of data involved, a separately bound Executive Summary shall be prepared for the final submittal. Appendices shall be bound separately from the Executive Summary and the main body of the report.

5.3. Review Comments. Comments resulting from the presentation and/or other review procedures will be forwarded to the ~~A-E~~ contractor for incorporation into subsequent submittals. The ~~A-E~~ contractor shall furnish written notification of intended action on each comment. Intentions of noncompliance with any comment should be substantiated in detail. Authorization to proceed to the next revised submittal will be granted in writing with or after the Contracting Officer's approval of the ~~A-E~~ Contractor's intended actions on the review comments.

5.4. Resubmittals of Inadequate Documents. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended submittal purpose.

5.5. Submittal Quantities and Schedule. Time allowed for preparation and submission of the information and/or documents required by this contract are exclusive of documented Government review time.

Government review time for a submittal is the period of time from the documented date of receipt of the submittal by the Government until the documented date of receipt by the ~~A-E~~ Contractor of the Contracting Officer's authorization to proceed with the work for the next submittal.

Each report and/or submittal shall be furnished in the following quantities:

Document	Quantity
Phase II, Interim Report/ Preliminary Submittal	20 Sets
Phase III, Advanced Final Submittal	20 Sets
Final Submittal	20 Sets

6. PERIOD OF SERVICE. Expeditious completion of each phase and increment of this contract is essential to the accomplishment of the energy conservation goals.

7. SCHEDULING AND REPORTING PROGRESS. The ~~A-E~~ Contractor shall prepare and submit an activity diagram or schedule which will indicate individual activities, significant events and milestones along with schedule dates for each. The schedule shall cover the entire scope and work period of the contract. In addition, the ~~A-E~~ contractor shall submit monthly reports of progress. These reports may be in letter or chart form and should be worded or keyed to indicate progress on the activity diagram.

8. GOVERNMENT-FURNISHED DATA. The following data and criteria are furnished initially to the ~~A-E~~ contractor for guidance. Deviation from the criteria will be permitted only when actual field conditions or other factors require such a change. Propose deviation with justification shall be submitted to the Contracting Officer for approval.

a. DOD Construction Criteria Manual, DOD 4270.1-M, Advance Edition, dated 1 June 1978.

b. Energy Conservation Investment Program (ECIP) Guidance (included in AFEP).

c. DAEN-MPE Multiple Address letter, dated 12 July 1979, subject: Progress Chart, Field Data Forms, and Report Format for Energy Analysis Projects (Base Wide Energy Studies).

d. ETL's 110-3-243, 256, 266, 271, 282, 294, 296, 302, 309 and Tech Note 77-2.

e. Architect-Engineer Instruction Manual, dated August 1977.

f. Omaha District Standard Legend Sheet (1 Mylar).

g. Location Plan for each installation (1 Mylar each).

h. Base Utility Systems Information maps for each installation (By each Installation).

i. AR 415-15.

j. TB ENG 353.

k. HNDSP-80-013-ED-ME.

l. Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy, and Heat Pump Systems; dated 1 July 1977.

m. TM 5-801-1.

n. TM 5-800-3.

o. Building Information Schedule (Manual) (By each Installation).

p. Utility Procurement Records (Including Reimbursables) (By each Installation).

q. Facilities Engineering Technical Data Report (By each Installation).

r. Army Facilities Energy Plan.

s. Military Aggregate Strengths (By Installation).

t. TM 5-815-2.

SCOPE OF WORK

Increments / Phases	Increment A: ECIP projects (Includes local use of Solar Systems)	Increment B: ECIP projects for Utilities Distribution Systems, EMCS Systems (includes Local Use of Solid Waste Fuels)	Increment C: New Solar Energy Systems (Except those directly connected with Increment A) (Feasibility study) Option II	Increment D: TE and SE Plants, Coal and POL Storage/Handling Facilities, Waste Fuel Facilities (Feasibility study) Option III	Increment E: Central Boiler Plant Projects (Feasibility) Option I	Increment F: Develop EMP (Emergency Management Plan)	Increment G: Projects not within ECIP guides. (with Increment A & B)
Phase I Data gathering; field trips and inspection.	Badger AAP ~~Cornhusker AAP~~	Badger AAP ~~Cornhusker AAP~~			~~Badger AAP~~ ol	~~Badger AAP~~ ph ~~Cornhusker AAP~~	Badger AAP ~~Cornhusker AAP~~
Phase II Analysis of data; feasibility and economic studies; evaluation and identification of projects.	Badger AAP ~~Cornhusker AAP~~	Badger AAP ~~Cornhusker AAP~~			~~Badger AAP~~ ol	~~Badger AAP~~ ph ~~Cornhusker AAP~~	Badger AAP ~~Cornhusker AAP~~
Phase III Preparation of DD Form 1391's and Program Development Brochures.	Badger AAP ~~Cornhusker AAP~~	Badger AAP ~~Cornhusker AAP~~			Badger AAP	~~Badger AAP~~ ph ~~Cornhusker AAP~~	Badger AAP ~~Cornhusker AAP~~